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**SYNCHRONIZING CLOCKS USING ENTANGLED PARTICLES** has been proposed by two independent teams, offering possible advantages over traditional techniques. In timekeeping, physicists already exploit the fact that an atom (or any other object at the quantum level) acts like a tiny clock. For example, an atom's nucleus in a magnetic field contains a "spin" analogous to an arrow or a second hand rotating at a precise frequency. But synchronizing two clocks has relied on more conventional approaches.

Now, one team (Jonathan Dowling, JPL/Caltech, 818-393-5343, [Jonathan.P.Dowling@jpl.nasa.gov](mailto:Jonathan.P.Dowling@jpl.nasa.gov)) proposes entangling two particles and sending them to the locations that need to be synchronized. Measuring one particle causes them both to start "ticking," so that when one spin begins at a "12:00 position," say, the other starts ticking at a complementary 6:00 position. Once this is set up, the two users can synchronize their clocks by communicating to each other when they measured their particle, and the direction that each person's spin was pointing.

In a separate scheme, Isaac Chuang of IBM (408-927-2845, [ichuang@almaden.ibm.com](mailto:ichuang@almaden.ibm.com)) proposes that two users at remote locations exchange a series of particles that serve as "quantum wristwatches." Determining the average time it takes a wristwatch to complete its round trip, measuring the wristwatch at each stop to determine its elapsed time, and adjusting the clocks on each end can allow precise synchronization to occur in many fewer steps than with traditional approaches, Chuang shows, because of the subtle interplay of quantum interference at work in a quantum particle. These new schemes may circumvent traditional problems of synchronization, such as distortions in radio signals sent from a GPS satellite to a user. However, entanglement-based synchronization calls for technical advances that, if realized, would also improve more conventional techniques, according to MIT's Seth Lloyd ([Chuang and Jozsa et al.](#), *Physical Review Letters*, 28 August 2000, [second paper](#).)

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